



United States
Department of
Agriculture

Forest
Service

Hoosier
National
Forest



Hoosier National Forest

Biological Evaluation for Threatened and Endangered Species

Houston South Project
June 13, 2019

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I. Introduction

This biological evaluation (BE) is for the Houston South Vegetation Management and Restoration Project (Houston South). The Forest Service is proposing to implement the 2006 Land and Resource Management Plan (Forest Plan) with the goal of maintaining and restoring sustainable ecosystems. The project proposes to promote regeneration of oak and hickory habitat and reintroduce fire to the landscape in areas of the Brownstown Ranger District that have not received this disturbance. Forest Service Manual (FSM) Section 2672.41 requires a biological evaluation and/or biological assessment (BA) for all Forest Service planned, funded, executed, or permitted programs and activities.

The objectives of this BE are to: 1) ensure that Forest Service actions do not contribute to loss of viability of any native or desired nonnative species or contribute to trends toward Federal listing, 2) comply with the requirements of the Endangered Species Act (ESA) so that Federal agencies do not jeopardize or adversely modify critical habitat (as defined in ESA) of Federally listed species, and 3) provide a process and standard to ensure that threatened, endangered, proposed, and sensitive species receive full consideration in the decision-making process.

The Hoosier National Forest supports known occurrences and suitable habitat for Federally threatened and endangered (TE) species, all of which were considered in this analysis. This BE documents the analysis of potential effects of the proposed project to TE species and associated habitat. It also serves as biological input into the environmental analysis for project-level decision making to ensure compliance with the ESA, National Environmental Policy Act (NEPA), and National Forest Management Act (NFMA).

The author of this evaluation used the best available science in making determinations to accompany this project-specific data. The Indiana Department of Natural Resources, Division of Nature Preserves, database was consulted for records of occurrence of species relevant to this evaluation (IDNR 2015, 2012). Records were also reviewed from the most recent mist-netting bat survey conducted on the Forest (ESI 2006, McClanahan 2010, 2011, 2014, York-Harris 2016).

II. Purpose and Need

The Houston South proposed action is based on, and would fulfill, Forest Plan direction associated with the goal of maintaining and restoring sustainable ecosystems. This project would meet Forest Plan direction to promote tree growth, reduce insect and disease levels and move the landscape toward historic conditions. It would also increase the resiliency and structure of forested areas (stands) by restoring the composition, structure, pattern, and ecological processes necessary to make these ecosystems sustainable.

There is a need to provide a mosaic of forest conditions dominated by hardwoods and restore dry hardwood forest ecosystems that have not experienced periodic disturbance due to fire or other naturally occurring events.

As maturing oaks and hickories age and die, they are being replaced by trees such as maple and beech. The oak and hickory provide hard mast-acorns and nuts-that are critical food for many wildlife species. Oak-hickory ecosystems need management activities to regenerate due to severe competition by less desirable species.

A lack of fire in the area is also causing oak-hickory seedlings to be suppressed by a shade tolerant mid-story. Reintroducing fire would promote regeneration and maintenance of mast producing oak and hickory. Secondly, there is a need to reduce the amount of pine in the action area to provide more suitable habitat to a wider array of wildlife species. Pines were planted in the 1940's and 1970's to aid in erosion control.

Pines are not native to the Hoosier National Forest. As the nonnative pine stands mature, the canopy grows closer together and reduces the amount of sunlight reaching the forest floor. The ground beneath the stands, in many places, has little (if any) other plants growing to provide cover or food sources for wildlife. By removing the pine plantations, the amount of forested habitat that is between 0 and 9 years of age would increase. The Forest Plan states the desired condition of this area is to maintain 4 to 12 percent of the area in young forest habitat.

Stand density is very high in portions of the action area and mortality is occurring. The proposal would reduce the density of the trees, improving forest health. Promoting healthy forest conditions and improving stand structure within the action area would improve the overall health of vegetation in the action area, making the ecosystem more resilient and reduce the effects of insects, disease, and climate change.

Lastly, there are also opportunities to repair poorly maintained roads and eroded areas to reduce sediment deposition into streams and lakes in the action area. Roads and trails in the action area may be better located to reduce sedimentation and increase viability of aquatic organisms. These actions may include relocating, reconstructing, or obliterating roads and possible placement of aquatic organism passages (AOPs), which are large culverts, in the action area.

Alternative 1 – Proposed Action

The Hoosier National Forest (Forest) proposes to promote regeneration of oak and hickory habitat through the use of timber harvest, herbicide treatments and prescribed fire. The current proposal implements approximately 1,104 acres of even-aged management which would create an estimated 8 percent of National Forest System (NFS) land in the action area in a 0 to 9 year old age class. The overall action area is approximately 23,359 acres (13,526 NFS acres and 9,833 private acres).

Table 1: Proposed silvicultural treatments (Swaim 2019)

Harvest	MA	Veg Type	Acres	Subtotal
Clearcut	2.8	Pine	401	
Shelterwood	2.8	Hardwood	703	
Total Even-aged management	2.8	Both	1104	1104
Thinning	2.8	Hardwood	2327	2,327
	2.8	Pine	78	78
Selection	2.8	Hardwood	462	462
Midstory Removal	2.8	Hardwood	234	234
Crop Tree Release	2.8	Hardwood	170	170
Total				4,375

The proposal also includes additional treatment of areas where timber is removed to promote regeneration of oak and hickory habitat. Total silvicultural treatments are 4,375 acres (Table 1). These silvicultural treatments were analyzed for only bat species since the treatments would not directly or indirectly affect the endangered mussel species.

Prescribed burn treatments are proposed to enhance habitat conditions to promote oak and hickory regeneration for mast in management area (MA) 2.8 and improve habitat for wildlife and plant species in MA 2.4 and 6.4. The Preliminary Proposed Action map displays the burn block area. Prescribed burns (15-22 estimated number of units) would occur within this burn block, not the entire burn block at once. Estimates for total acres for prescribed burning are 13,300 acres

The project also proposes road construction and reconstruction. There are approximately 16.2 miles of Forest Service roads (FSR) in the action area. The majority, 15 miles, are maintenance level (ML) 1 roads with 0.7 miles of ML 2 and 0.5 miles of ML 3. It is estimated that 6.2 miles of roads would be decommissioned.

Of the approximate 16.2 miles of FSR, 8.6 are co-located with trails; however, 4.6 miles are in the area of proposed timber management. This includes the southern section of the Fork Ridge Trail and portions of the Hickory Ridge Trail system. Roads that are to be decommissioned could have vernal pools installed in their footprint where appropriate. Vernal pool installation could also occur on temporary roads or skid trail for rehabilitation purposes.

The analysis will consider opportunities to repair poorly maintained roads and eroded areas to reduce sediment deposition into streams and lakes in the action area. Additionally, roads in the action area may be better located to reduce sedimentation. Opportunities may exist to relocate, reconstruct, or obliterate roads in the action area while providing adequate aquatic organism passage (AOP). Project implementation would begin in 2020, be staged over time, and may take several years to complete. The work would be completed using contracts as well as Forest Service employees.

In summary, the main treatments to be analyzed would be silvicultural treatments, herbicide treatments, prescribed fire, road construction/reconstruction, AOP and vernal pool installation.

Alternative 2 – No Action

With this alternative, none of the recommended road decommissioning or reconstruction would take place. No silvicultural or prescribed fire activities would occur. The benefit of vernal pools and AOPs to bats, herpetological, and fish species would not take place. This alternative does not meet the purpose and need for this project.

III. Action Area Description

The majority of the action area is in the northwest corner of Jackson County, on the Brownstown Ranger District (Figure 1). A small portion does occur in the northeast corner of Lawrence County.

The legal descriptions for the action area include:

- T7N, R2E, all or portions of Sections 25-28 and 33-36
- T7N, R3E, all or portions of Sections 20-23, 26-30, and 31-36
- T6N, R3W, all or portions of Sections 2-6, 7-11, and 14-18
- T6N, R2E, all or portions of Sections 1- 4, 10-12, and 13

All proposed silvicultural treatments would occur on NFS lands. Prescribed fire could be applied where adjoining U.S. Army Corps of Engineers land and private landowners express interest and are willing to enter into an agreement.

The action area is over 23,000 acres in size and can be generally described as a mixed-deciduous forest with patches of coniferous trees. Nonnative and invasive (NNIS) plants are present throughout the action area with variable concentrations.

Tree species present include oak (*Quercus spp.*), maple (*Acer spp.*), beech (*Fagus grandifolia*), hickory (*Carya spp.*), sycamore (*Platanus occidentalis*) and tulip (*Liriodendron tulipifera*). Common mesic plant species are found throughout the action area such as greenbriar (*Smilax sp.*), poison ivy (*Toxicodendron radicans*), Virginia creeper (*Parthenocissus quinquefolia*), mayapple (*Podophyllum peltatum*), and goldenrod (*Solidago spp.*). A picture depicting the action area may be found below (Figures 2-5). A more thorough botanical evaluation, including NNIS, is also available (Coon 2019a, Coon 2019b).

The geographic scope of this biological analysis (direct, indirect and cumulative effects) for terrestrial plants and animals is based on the Ecological Classification System and primary habitat association. The geographic scope of the analysis for Federal TE species is determined by Subsection in which the species are known to occur.

The action area is within the Brown County Hills Subsection (222Em). Historically fire was a predominant natural disturbance, burning with low frequency and intensity over moderate size areas between natural barriers. Fire, large herbivores, windstorms, insects, and disease created canopy gaps and kept the canopy open on some ridges.

Ecological landtype (ELT) mapping divides the proposed treatment areas into three different ELTs (Van Kley *et al.* 1995). Zhalinin and Parker (2004) conducted a revised ecological classification for the Hoosier National Forest. This information provides the basis for determining potential or suitable habitat for animal and plant species. The approximate acreage amounts (all estimates have been rounded up to eliminate decimals) of the ELT within the proposed action area are:

- ELT 1 – Ridge, (2751 acres; 12%)
- ELT 2 – Slopes, (12821 acres; 55%)
- ELT 6 – Bottomland (7668 acres; 33%)

The action areas may be further characterized by ELTPs. Common ELTPs that could occur within the three ELTs are found in the table below (Table 2).

Table 2: Ecological Land Types (ELTs) and associated Ecological Land Type Phases (ELTPs) of the Brown County Hills Subsection (USDA FS 1995) within the proposed Houston South Project.

ELT	Associated ELTPs	Landscape Position	ELTP Description	Acres (% of Project Area)
RIDGES				2,751 ac (12%)
	10	Dry Ridges	Quercus alba-prinus/ Vaccinium	
	11	Dry-Mesic Ridges	Quercus alba-Acer saccharum/Parthenocissus	
SLOPES				12,821 (55%)
	20	Dry Slopes	Quercus alba-prinus/Carex Picta - Vaccinium	
	21	Dry-Mesic Slopes	Quercus alba-Acer saccharum/Partenocissus	
	12	Mesic Ridges	Fagus-Acer saccharum/Arisaema	
	13	Mesic Ridges	Acer saccharum/Arisaema-Jeffersonia	
	22	Mesic Slopes	Fagus-Acer saccharum/Arisaema	
	23	Mesic Slopes	Acer saccharum/Jeffersonia	
BOTTOMLANDS				7,668 ac (33%)
	40	Mesic Bottomlands	Fagus-Acer saccharum/Arisaema	
	41	Mesic Bottomlands	Platanus/Asarum	
	42	Bottomlands	Fagus-Acer saccharum/Boehmeria-Asarum	
	43	Bottomlands	Acer saccharinum/Boehmeria	

IV. Consultation History

The Forest Service undertook this biological evaluation in accordance with Forest Service Manual 2670 direction and the 2006 Hoosier National Forest Land and Resource Management Plan (USDA FS 2006). The Forest Service consulted with the US Department of the Interior, Fish and Wildlife Service (USDI FWS), providing them with the project and treatment descriptions. On June 7, 2019, a preliminary copy of this BE was provided. Two related but separate documents evaluated the potential project effects for Regional Forester Sensitive Species (RFSS), (Coon 2019a, Harriss 2019).

V. Field Survey and Results

The action area was surveyed during 2019 on several occasions (April 8, April 15, April 24, May 3, May 8, and May 15) by Forest Botanist Cheryl Coon, Wildlife Biologist Steve Harriss, Wildlife Biologist Trainee Bryan King, and Biological Science Technician Evie Phelps.

Animal surveys consist of searching for individuals, signs of their presence (such as scat, tracks, calls, or nests), and/or potential habitat. Some species could not be eliminated from further consideration based on known range, and because there were no existing field surveys in portions of the action areas. Some botanical species could still be identified at the time of inspection. The current IDNR Natural Heritage database was also used to determine rare plant species in the action area along with Forest inventories of rare plants (Olson *et al.* 1991).

Review of the Indiana Heritage Database does indicate presence of TE species within the action area and the surrounding vicinity (IDNR 2015, 2012). During the site-specific surveys, no TE species were located. According to the cave database and ground-truthing, there are no known caves located in the action area. The closest cave is approximately 3.5 miles away.

VI. Management Treatments

The primary treatments of the Houston South Project include silvicultural treatments, herbicide treatments, prescribed fire, road construction/reconstruction, AOP and vernal pool installation. These would be implemented over the lifespan of the project and not all at one time.

Four of the treatments (herbicide treatments, road construction/reconstruction, AOP and vernal pool installation) do not have take associated with them. Therefore, these four treatments will only be briefly addressed below. The analyses for silvicultural treatments and prescribed fire are more thorough and are described secondly.

There are five habitats or activities (components) of bat species that were analyzed to evaluate potential indirect and direct effects that the project treatments could have. The potential effects of the five treatments on the specific bat components, are substantiated in the specific species write-ups.

Herbicide Treatments

Herbicide use is proposed in the Houston South Project and would take the form of nonnative invasive species treatments, hack and squirt methods or foliar treatments. Herbicides are covered in the Programmatic Biological Opinion for the Hoosier National Forest and no take is anticipated from this management activity (USDI FWS 2006). Therefore, there would be no direct or indirect effects to bat species concerning herbicide use.

Road construction/reconstruction

This activity can involve tree removal and grading. Long-term benefits such as roost tree availability increased foraging opportunities and new travel corridors outweigh short-term impacts to species (removal of potential roost trees and energy expenditure). Road construction and reconstruction are covered in the Programmatic Biological Opinion for the Hoosier National Forest and no take is anticipated from this management activity (USDI FWS 2006). Therefore, there would be no direct or indirect take to bat species concerning these activities.

Aquatic organism passage installation

The proposed construction of AOP structures within the action area would have direct benefits to aquatic organisms and their habitats. All three proposed AOPs would replace undersized and obsolete infrastructure that prohibits upstream movement of not only fish but also other aquatic species and even terrestrial species that use riparian areas as travel routes. These are typically inside the right-of-ways (ROWs) of roads or highways. Past analysis of AOP installation has either benefitted bat species or had no effect. By improving aquatic habitat, aquatic insects would be indirectly improved. No take is anticipated from this management activity.

Vernal pool installation

Vernal pool installation would be similar to AOP installation. No trees are usually removed for this installation since it is a rehabilitation strategy to improve existing habitat. If a tree must be removed, it is done during the bat's inactive period. Vernal pools provide a valuable water source for bats and have shown to provide habitat for Indiana bats. These would only be installed on existing footprints of a road to be decommissioned, which is potentially 2.6 miles of road. They can be installed by heavy equipment or by hand, where appropriate soil conditions exist. Past analysis of vernal pool installation has benefitted bat species. No take is anticipated from this management activity.

Prescribed Fire

This Houston South Project proposes to provide a mosaic of forest conditions dominated by hardwoods and restore dry hardwood forest ecosystems that have not experienced periodic disturbance due to fire or other naturally occurring events. Prescribed fire is an important tool in the restoration and maintenance of native vegetation as burning reduces competition from invading, non-fire adapted species. The Hoosier National Forest proposes to treat up to 13,300 acres with prescribed fire in the action area to promote oak regeneration, reduce hazardous fuel build-up, and use prescribed fire to restore ecological processes.

Burns are conducted under conditions that generally result in low-intensity burns; that is, only ground cover, shrubs, and trees less than 2 inches in diameter are burned. Under these conditions, few snags are lost, while a small number of snags are created by fires. Burning may have to be repeated as necessary to reach desired conditions and promote plant diversity.

Potential effects to bats include increased predation of fleeing bats, susceptibility to smoke and flames, or smoke/gases could be trapped inside caves harming hibernating bats and the taking of potential roost trees.

The use of prescribed fire may reduce the number of potential roost trees within the action area. Snags serving as bat roosts could be consumed and activities, such as construction of firelines, could result in the removal of trees. However, the use of prescribed fire is likely to create additional roost trees (Carter et al. 2002). Construction of firelines, involving removal of trees, would occur prior to April 15 or after September 15 so there would be no direct effects to bats. The one exception would be if the fireline or human safety was in jeopardy during a prescribed burn activity.

The construction of firelines is predominately not ground disturbing and therefore does not produce sedimentation. The placement of firelines attempts to use natural features on the landscape (rivers, streams, etc.) or roads/trails as firelines to be more efficient.

The estimated amount of firelines to be assessed for hazard trees ranges from 66 to 74 miles over the next 20 years. It is difficult to determine the quantity of hazard trees per mile of fireline that could be taken. This depends on the species present, topography and density. Generally, an increase in fireline would increase the hazard tree potential and therefore an increase in the amount of potential roosting trees. No negative direct effects are anticipated by the installation of firelines.

A burn plan for the project would be completed prior to implementation to ensure ignition would occur on days when weather conditions and fuel moisture levels allow for predominately backing fires that create cool, low-intensity burns. However, areas with heavy fuel loads may experience more moderate-intensity burns. Unburned areas would not be re-lit; instead, mosaic burn patterns would be retained. As a result, most burn units would be burned in fall/winter or early spring, which is outside the times Indiana bats are active. Burning during the bat's inactive period (before April 15 or after September 15) would not result in any direct negative effects to local bat species concerning roost trees.

Growing season burns, mid-April to mid-September, would be permissible under this project and could occur in up to 4,500 acres. The intent of these burns would be to increase botanical diversity or reduce unwanted vegetation, such as nonnative invasive species in areas.

The vast majority of prescribed burns would not occur during bat's active period of April 15 – September 15. However, this project was designed to take advantage of potentially longer burn windows that could occur. This means that prescribed burn activities for the Houston South Project could also occur during the growing season (active period for bats), on April 15 or after and through September 15 to reach desired conditions. Albeit, this would be infrequent and possibly considered a rare event due to the onset of green up.

The closest Indiana bat hibernacula is over 11 miles from the cumulative effects boundary and over 16 miles from the action area. The closest gray bat hibernacula is over 35 miles away in Harrison County (King 2019). The closest northern long-eared bat hibernacula is over 3.5 miles away in Monroe County. Therefore, no effects to caves or hibernating bats are anticipated.

The use of prescribed fire would improve within stand conditions for foraging by the Indiana bat and northern long-eared bat by opening up the understory. Insect biomass, although initially reduced in the burn area, would subsequently increase as the re-growth of herbaceous vegetation occurs. This is likely related to nutrient release and the resulting increase in herbaceous forage quality. Roosting habitat would also likely improve in the long-term, since few snags would be lost under low-intensity fires, and a small number of new snags would be created (USDI FWS 2006).

Indiana bats are very well adapted to modifications to their habitat (Gardner et al. 1991) and they have responded to naturally occurring fires throughout their species' existence. They can be considered a fire-adapted species since the majority of its range historically consisted of fire maintained ecosystems. It is reasonable to predict that adult Indiana bats would successfully flee from burn areas (USDI FWS 2006). Non-volant pups cannot respond if their roost tree is engulfed by fire or exposed to smoke. However, maternity roosts are protected by Forest guidelines restricting prescribed burning within a 1 mile radius from occupied roosts during the breeding season (USDA FS 2006).

Regarding bats, this management activity would create some forest gaps, create snags and help in the regeneration of oaks and hickories. As stated earlier, all three of these outcomes would benefit Indiana bat habitat for the long-term.

However, short-term effects are anticipated in the form of foraging habitat modification, travel corridor modification, increased predation of fleeing bats and smoke and/or fire affects.

Foraging habitat and travel corridor changes would occur both from direct response to burns (i.e., roost trees and canopy burning) and from direct response to on-the-ground fire management activities (i.e., removing trees for fire breaks and access roads/lanes) (USDI FWS 2006).

Prescribed fire is a specific management activity included in incidental take estimates in the Programmatic Biological Opinion (USDI FWS 2006).

Silvicultural Treatments

The proposal also includes additional treatment of areas where timber is removed to promote regeneration of oak and hickory habitat. Total silvicultural treatments are 4,375 acres (Table 1). This data, and more thorough silvicultural descriptions, can be found in the Forest's silvicultural report (Swaim 2019).

Clearcuts are proposed in the Houston South Project totaling 401 acres. The sizes are limited to 10 acres per occurrence (USDA 2006). Although open forest is not preferred habitat of Indiana bats, the relative diminutive area associated with most clearcut harvests (10 acres) will not likely degrade available habitat within the Hoosier National Forest's boundaries (USDI FWS 2006). In addition, these proposed clearcuts only occur in pine stands and Indiana bats typically do not prefer pine over native deciduous forests. Lastly, all snags possessing roost-tree characteristics, not deemed hazardous, will be retained in the clear cut area, as well as trees defined within the standards and guidelines section (USDA FS 2006). This management practice is expected to produce direct and indirect take of the Indiana bat due to the practice occurring during the bat's active period and the removal of potential roost trees.

Shelterwood cuts are estimated to be 703 acres in the action area. This is the removal of undesirable competition to promote the regeneration of target or desired species. These cuts open up small gaps in the forest canopy allowing additional sunlight to reach the forest floor. The conclusion is that Indiana bats prefer these gaps compared to closed canopy forests and it is likely that shelterwood harvests would increase foraging habitat (USDI FWS 2006). This activity could take place any time of the year. It is expected that some direct and indirect take is anticipated for this management activity due to the practice occurring during the bat's active period and by the removal of potential roost trees.

Uneven-aged timber harvest, such as the proposed selection harvest, would likely result in improved foraging and roosting habitat for the Indiana bat (USDI FWS 2006). Timber harvest activities may take up to 10-15 years to complete the project. This could take place any time of the year. Therefore, summer Indiana bat habitat may be affected in the short-term, but project activities may show long-term improvements for bat species.

Thinning is also proposed for the project with 78 acres being in pine and 2327 being in hardwoods. This could take place any time of the year. This potentially can directly and indirectly affect bat roosting opportunities. Therefore, summer Indiana bat habitat may be affected in the short-term, but project activities may show long-term improvements for this species by increasing solar exposure to maternity trees.

Timber stand improvement (TSI) treatments are evaluated on a case-by-case basis by the Fish & Wildlife Service since it is variable and project specific (USDI FWS 2006). For this project, this management practice is not expected to produce direct take of the Indiana bat due to the practice occurring during the bat's inactive period. This practice could result in indirect effects however, with bats potentially having to expend more energy locating an alternate roost.

Mid-story removal would occur on approximately 234 acres of the Houston South Project. This would be accomplished through harvesting and the hack and squirt method. Instead of felling trees, herbicide treatments would kill the tree and leave it standing. This would create a gap and snags, creating potential roosting habitat for the Indiana bat. The herbicide treatments could occur any time and would not produce negative direct or indirect effects.

Although mid-story removal would reduce clutter, provide better corridors and create potential roosting opportunities, this management activity is expected to have some effects. For this project, this management practice is not expected to produce direct take of the Indiana bat due to the practice occurring during the bat's inactive period. This practice could result in indirect effects however, with bats potentially having to expend more energy locating an alternate roost.

Crop tree release management would occur on approximately 170 acres of the Houston South Project. This would be in the form of timber stand improvement, similar to mid-story removal in reference to the sizes of trees to be removed (approximately 6-10 inch d.b.h) but not as intense as mid-story removal. It does not include any commercial removal of trees. The goal would be the remove trees most suited for other trees to thrive. The hack and squirt method would be used on a portion of trees during this type of management as well. Instead of felling trees, herbicide treatments would kill the tree and leave it standing. This would create a gap and snags, creating potential roosting habitat for the Indiana bat. The herbicide treatments could occur any time and would not produce negative direct or indirect effects. Tree removal would only occur during the bat's inactive period and would not produce direct negative effects.

VII. Federally Endangered, Threatened, or Proposed Species

The US Department of Interior, Fish and Wildlife Service have identified six Federally listed species as having part of their range on the Hoosier National Forest. These species are the endangered eastern fanshell mussel (*Cyprogenia stegaria*), the endangered gray bat (*Myotis grisescens*), the endangered Indiana bat (*Myotis sodalis*), the threatened northern long-eared bat (*Myotis septentrionalis*), the endangered rough pigtoe (*Pleurobema plenum*) and the sheepnose muscle (*Plethobasus cyphus*).

Eastern fanshell mussel (*Cyprogenia stegaria*)

Within the vicinity of the proposed Houston South Project, there is no habitat for and no known records for the eastern fanshell mussel (IDNR 2015, 2012). The fanshell mussel typically occurs in gravel-bottomed stream of medium to larger sized rivers. The action area contains no habitat conducive to this mussel. The main stem of the East Fork of the White River in Martin and Lawrence Counties, Indiana, is the only location where the fanshell is known to occur within the Hoosier National Forest boundary. This location is over 23 miles from the action area. A second known location, outside of the Forest boundary, occurs in the East Fork of the White River, Jackson County greater than 6 miles away.

There are no known occurrences of the fanshell mussel in the action area, no habitat for this species and the project would not alter or affect restoration of natural stream flows in the East Fork of the White River or its tributaries. Therefore, there would be no direct, indirect or cumulative effects to this species from implementing this project.

Gray bat (*Myotis grisescens*)

Effects to gray bat were considered in this BE because habitat features found in the action area could be used by this species and it is assumed this species may occur on the entire Hoosier National Forest. The gray bat occupies a limited geographic range in limestone karst areas of the southeastern United States. They are mainly found in Alabama, northern Arkansas, Kentucky, Missouri, and Tennessee. A few can be found in northwestern Florida, western Georgia, southeastern Kansas, and southern Indiana (USDI FWS 2019).

The gray bat is Indiana's only true cave bat, requiring caves for roosting, breeding, rearing young, and hibernation. Summer habitat requirements for the gray bat include forests near permanent water and caves (NatureServe 2019). There is no designated critical habitat for the gray bat on the Hoosier National Forest. For this species, the effects to hibernation, summer habitat, roosting, foraging, and travel corridors were analyzed.

The closest captures of gray bats occurred over 50 miles away on the Tell City Ranger District. Whitaker (1996) captured a single male adult gray bat near the Hoosier National Forest boundary in Perry County in August of 1996. Researchers captured another gray bat near the Forest boundary of Perry County in 1998 (3/D International 1998). Surveys by Whitaker (Whitaker and Gummer 2001) throughout the Ohio River corridor, have resulted in only one gray bat capture. Most recently, a single non-reproductive female was captured on the Tell City Ranger District in July 2006 (ESI 2006).

During the 2010 bat surveys, acoustical surveys showed a strong likelihood of gray bat occurrence in the Patoka River bottoms (McClanahan 2010). Acoustic surveys in the Pleasant Run Unit (2012-2019), also showed probable gray bat occurrence. The acoustic routes were ran three times a summer and only produced nine occurrences from 2012-2018. This implies that their occurrence is limited but they do occur. This would be the closest occurrence and inside the action area. To date, only three gray bats have been captured within the Hoosier National Forest boundary. Therefore, it is likely that the action area receives some, but limited, use by a small number of foraging gray bats and consequently no negative effects are anticipated.

Hibernation and Roosting

The gray bat occupies caves for winter hibernation and typically a different cave for summer roosting. It is not found roosting in trees or foliage. Roost sites are nearly exclusively restricted to caves throughout the year. Occasionally, non-cave roost sites are used such as bridges, storm sewers or buildings. This would be considered a rare occurrence. Approximately a dozen bridge sites were inspected in the summer of 2017 (Harriss, King 2017) in the Pleasant Run Unit. No bats were located under bridges.

There are no records of caves being used by gray bats on the Hoosier National Forest. This is based on that no gray bat caves have been located on the Hoosier National Forest, even after over 15 years of cave surveys during the winter and summer months. There are no known caves inside the action area. There are caves, west of the action area, that are inside the cumulative effects boundary. This is over 3.5 miles away. These caves have been inspected and have not shown to have gray bats (Harriss 2018, Lewis 2011).

Because there are no known caves being used by gray bats in or near the action area and Forest Plan Standard and Guidelines (USDA FS 2006) extend protection for cave resources, the proposed Houston South Project should not directly or indirectly affect the gray bat concerning hibernation, staging/swarming or roosting opportunities.

Summer Habitat and Foraging

Gray bats typically use multiple roost sites (caves) and travel from roosts to foraging areas under the forest canopy. Gray bats forage on flying insects from dusk to dawn along perennial streams and over lakes and ponds. Gray bats are associated with aquatic insects, such as mayflies and beetles. These bats may forage over substantial distances from roosts. Although individuals may travel up to 21 miles between prime feeding areas over lakes or rivers and occupied caves, most maternity colonies are 0.6-2.5 miles from foraging locations. Newly volant gray bats can travel up to 6 miles between roost caves and foraging areas (NatureServe 2019).

Perennial streams, lakes and ponds do exist inside the action area and these resources would be adjacent to implementation of the project. Although there are imposed risks to the soils from harvesting and burning, correctly implemented best management practices (BMP's) should mitigate them.

There are several degrading roads and trails that are currently impacting the South Fork Salt Creek Watershed in a negative way due to sedimentation. Some of the roads and trails would be rehabilitated with BMP measures to reduce erosion/sedimentation. There are several head cut ephemeral streams which would also be repaired using watershed restoration techniques. Water quality within the Houston South Project should remain the same or be slightly improved based on initial disturbances and improvements (Menke 2019).

Fish sampling and habitat evaluations were performed within the Houston South action area on nine stream sites from 2017-2019 by Fisheries Biologist Len Kring. The extremely flashy hydrology is playing a major role in the ecological health of these watersheds.

The proposed construction of AOP structures within the action area would have direct benefits to aquatic organisms and their habitats. All three proposed AOPs would replace undersized and obsolete infrastructure that prohibits upstream movement of not only fish but also other aquatic species and even terrestrial species that use riparian areas as travel routes.

The Houston South project should not have negative effects on riparian and instream habitat, especially if Forest Plan standards and guidelines are adhered to and proper BMPs are installed. Installation of AOPs would increase the quality of instream habitat including benefitting riparian habitat by restoring natural flow regimes and material transport (Kring 2019).

Vernal pools are a valuable water source for bat species and provides a forage area for insects as well. Indiana bats have been captured in a vernal pool complex on the Pleasant Run Unit in 2010 along with northern long-eared bats. Due to the installation of vernal pools at some of the road sites, this would help bat species and create a beneficial effect for the gray bat.

To summarize, The Houston South Project would be using Forest Plan Standards and Guidelines and BMPs to protect riparian areas and aquatic resources. Riparian areas and aquatic resources are expected to benefit from this project. This in turn would protect insect resources the gray bat feed upon. This would indirectly affect the gray bat with potential beneficial effects to their summer habitat and foraging areas.

Travel Corridors - Existing roads and temporary skid trails, in the harvest areas, would be less cluttered as a result of this project. Both of these could provide better travel corridors for the gray bat, although the majority of the travel corridors should be close to riparian areas. However, acoustical signatures have been found along county roads inside the action area so it is possible that the bats could also use temporary skid trails. After the temporary skid trails have served their function, these areas can be repurposed to serve as vernal pools where appropriate. These would benefit bat species by providing a water source, enhancing the travel corridors and improving foraging opportunities.

To summarize, project activities should not have direct or indirect effects on winter hibernacula, staging/swarming or roosting of the gray bat. Project activities may affect summer habitat, foraging habitat and travel corridors but it is not likely to adversely affect this species. Effects to summer habitat would be staggered over 10-15 years and would not occur all at one time. Project activities would show long-term improvements with improvements to water quality and riparian habitat, increase in plant/insect diversity (better foraging potential) and an increased water supply by vernal pool creation.

Sheepnose Mussel (*Plethobasus cyphus*)

The sheepnose mussel occur in coarse sand-gravel-cobble substrates of larger rivers and streams. Within the vicinity of the proposed Houston South Project, there are no known records of the sheepnose mussel (IDNR 2012, 2015). The main stem of the East Fork of the White River in Martin County contains the closest siting on the sheepnose mussel, approximately 26 miles from the action area.

There are no known occurrences of the sheepsnose mussel in the action area, no habitat for the species and the project would not alter or affect restoration of natural stream flow in the East Fork or its tributaries. Therefore, there would be no direct, indirect or cumulative effects to this species from the implementation of this project.

Indiana bat (*Myotis sodalis*)

There are occurrences of the Indiana bat, according to the Indiana Natural Heritage Data Center, within the action area (IDNR 2015, 2012). The most recent is in 2010. It is assumed that they are present in the vicinity because potential habitat (mature forests containing trees with exfoliating bark) exists adjacent to and inside the action area.

There is no designated critical habitat for the Indiana bat on the Hoosier National Forest. The closest Priority One hibernacula are in Greene and Harrison counties, and they are listed as critical habitat for Indiana bat. Ray's Cave is located west of the Brownstown Ranger District in Green County; Wyandotte Cave is located east of the Tell City Ranger District in Crawford County. Twin Domes Cave, another Priority One hibernaculum, lies nearly due east of Wyandotte Cave in Harrison County.

Mist netting studies in Crawford and Perry counties have documented use of the Hoosier National Forest by six Indiana bats. Of these six, four males occurred in the Tell City Ranger District, Perry and Crawford counties (Brack *et al.* 2003). In July 2006, one male and two females were caught on the Tell City Ranger District (ESI 2006). In June 2010, a single male Indiana bat was captured less than 0.25 miles from the action area (McClanahan 2010). This capture occurred in a forested area, similar to Houston South, that was enhanced with vernal pools. In 2010, another Indiana bat was captured in the Yellowwood State Forest, just inside the cumulative effects boundary.

Acoustic routes that were performed in the Pleasant Run Unit (2012-2018), only produced one occurrence of an Indiana bat in 2015. This implies that their occurrence is limited but they do occur. Since there are a number of Indiana bat hibernacula within 10 miles of Hoosier National Forest, it is likely that Indiana bats use appropriate habitats on the Hoosier National Forest for roosting and foraging.

There are five habitats or activities (components) of the Indiana bat that were analyzed to evaluate potential indirect and direct effects that the project treatments could have.

Hibernation - Within particular climatic constraints, the winter range of the Indiana bat historically is restricted to regions of well-developed karst, i.e. limestone caverns, which serve as hibernacula (Natureserve 2019, USDI FWS 2007). Most hibernacula are in caves, but occasionally Indiana bats will use man-made hibernacula such as abandoned mines. Forest Service personnel found no caves in the action area but they can be found within the cumulative effects boundary. No Indiana bat hibernaculum is known to occur within a 5-mile buffer of the action area. The 5-mile distance has biological significance because Indiana bats have been documented roosting and foraging up to a maximum distance of approximately 5 miles (8 km) from their winter hibernacula during the fall swarming period (Rommé *et al.* 2002). The closest known Indiana bat hibernacula is approximately 16 miles away from the action area, in Monroe County.

Because there are no known hibernacula in or near the action area, the proposed Houston South Project would not directly or indirectly affect hibernacula of the Indiana bat nor affect swarming/staging behavior of the Indiana bat. Since there are no direct or indirect effects pertaining to Indiana bat hibernation, there are no cumulative effects.

Summer Habitat - Activities associated with the Houston South Project may affect the summer habitat of the Indiana bat since the overstory, density and structure would change as result of harvest. Cutting an Indiana bat roost tree when bats are present in the tree is likely to result in some individuals being directly injured or killed (direct take) (USDI FWS 2006), however, to date, this has not been documented

on the Hoosier National Forest. Loss or alteration of habitat can also affect individuals (indirect take) and local populations (maternity colonies).

The Houston South Project would use existing roads as much as possible, to remove timber. This would reduce the probability that a potential roost tree may be lost. The majority of new roads are either roads that have not been officially counted in the forest roads database or part of a legacy road system with few large trees through the corridors. This would also reduce the amount of lost roost trees that have bat potential. However, a large portion of the roads would have to be widened or brought up to current standards and this may involve clearing of potential roost trees.

Activities such as log landings may cause the inadvertent loss of a small number of potential roost trees used in the summer for the Indiana bat. In the long-term, this management action is not likely to have a noticeable adverse effect on the overall population of Indiana bats across the Forest. No direct or indirect take is anticipated from this management practice (USDI FWS 2006).

Timber harvest activities may take up to 10-15 years to complete. The removal of potential roost trees and alternate roost trees during the summer months are possible outcomes that would have direct and indirect effects to the Indiana bat. Therefore, summer Indiana bat habitat may be affected in the short-term, but project activities may show long-term improvements for this species. This includes improved foraging and roosting habitat, small gaps creation in the forest canopy allowing additional sunlight to reach the forest, new travel corridor creation along with the addition of vernal pools as a water source.

Roosting – Removal of trees using group or single-tree selection harvest could result in the loss of potential roosts for Indiana bats. Though these harvest methods may remove potential alternate roosts, the availability of these roosts is likely non-limiting on the Forest. The number of trees, however, within any given area of the landscape should not be considered the sole determinant of roosting habitat quality. It has been shown that gap creation increases foraging and potential roosting habitat for the Indiana bat, so single-tree selective harvests would likely have a positive effect on Indiana bat habitat for the long-term.

At present, the action area is approaching complete canopy closure and the Houston South Project action area, may represent poor maternal roosting habitat, as most snags receive insufficient solar exposure. Consequently, incident solar radiation at potential roost trees may be as, or more, limiting than the density of suitable roost trees. Because there are no known maternity colonies within the action area, and because the action area may be of limited quality as maternal roosting habitat, the Houston South Project, is unlikely to adversely affect long-term roosting, and in particular maternal roosting, of the Indiana bat. In fact, the proposed uneven-aged harvest of hardwoods within the action area, may improve long-term roosting habitat quality by providing an increase of solar exposure to the unharvested trees (USDI FWS 2006).

Remaining trees would continue to mature and would gain in suitability as roosts. Consequently, with respect to maternal roosting habitat, given protection of snags, creation of openings within a predominantly closed canopy, and addition of vernal pools (water source), the proposed project may improve maternal roosting habitat within the action area and so have long-term benefits for the Indiana bat.

If present, timber operation accidents (e.g. accidentally causing a snag to fall down while purposefully felling a target tree during a timber harvest) may directly affect the Indiana bat. The likelihood of a male Indiana bat being harmed or killed while roosting in a tree targeted for harvest is very remote. It is highly unlikely that a bat would remain in a tree being cut down, and if it did, the odds that the tree would fall exactly on the spot in the tree where the bat was roosting are remote.

Furthermore, since male Indiana bats predominantly roost alone, there would be little chance for multiple bats being taken if this improbably scenario ever unfolded (USDI FWS 2006). A potential roost tree could be damaged by felling a target tree also.

This however, is considered to be a very low percent. The Fish and Wildlife Service used one-half of one percent (0.5%) as the ratio of trees potentially having roost tree characteristics for timber operation accidents in their 2006 Programmatic Biological Opinion (USDI FWS 2006).

Specific timber management activities were included in incidental take estimates in their 2006 Programmatic Biological Opinion (USDI FWS 2006). Timber stand improvements, such as intermediate thinning and midstory removal, were not analyzed in the Programmatic Biological Opinion.

Instead, they were to be evaluated on a case-by-case basis at the project level (USDI FWS 2006). Single-tree and group selection are not explicitly included in the Incidental Take Statement for the Forest Plan, but an estimate of timber operation accidents can be used to determine an anticipated level of take for Indiana bats from these and other timber management activities not specifically addressed in the Programmatic Biological Opinion and Incidental Take Statement (King 2011).

Based on similar timber sales that have occurred on the Forest from approximately 2000-2018, the Forest has estimated the number of timber operation accidents that could occur for the Houston South Project. Timber accidents have been tracked on these past twelve timber sales that involve hardwood and pine thinning. The analysis shows that 0.31 trees per acre have been damaged in hardwood thinnings and 0.93 trees per acre were damaged during pine thinning (Combs 2018).

After consulting with the US Fish & Wildlife Service, Bloomington Field Office, it was decided that the 0.31 trees per acre number can appropriately be reduced by half. This is due to the majority of the damaged trees were living, tight-barked trees and that only a fraction of the damaged trees were likely to be snags/shagbarks/potential bat roost trees. The new number of trees per acre, that could be a potential roost tree, would then be 0.16 trees. Consequently, 0.16 trees per acre will be the number used to assess management activities not covered under the Programmatic Biological Opinion.

For the Houston South Project, this calculates to 373 trees being damaged during hardwood thinning operations and 73 trees for pine thinning operations. Also, using the same 0.16 trees per acre, this calculates to 74 trees being damaged for the 463 acres of selection cuts. Totals of potential timber operation accidents would then be 520 trees.

Since these types of timber management are to be evaluated on a case-by-case basis at the project level (USDI FWS 2006), further analysis was warranted due to the highly variable topography and slope of the action area. It is estimated that only 70% of the thinning and selection areas are obtainable (Combs 2019). Therefore, the total list above was reduced by 30% to achieve the final timber operation accident number.

Therefore, the final estimated amount of for the Houston South Project would be 364 trees (Table 3) and this would be accounted for as per the Programmatic Biological Opinion's requirements.

Table 3.
Timber Accidents by Treatment (Combs 2019)

Treatment Type	Proposed Acres	Damaged Trees /Acre	Total	Final Total w/30% Reduction
<i>HW Thinning</i>	2330	0.16	373	261
<i>Pine Thinning</i>	78	0.93	73	51
<i>Selection</i>	463	0.16	74	52
<i>Final Timber Operational Accident Number for Calculations</i>				<i>364</i>

Since this project could take 15 years to complete, the average amount of accidents would be approximately 24 trees per year. This is well below the 100 trees per year accounted for in the Incidental Take Statement (USDI FWS 2006).

Standards and Guidelines from the Forest Plan would ensure that timber harvest is done to maximize the benefit to Indiana bats (USDA FS 2006). Therefore, roosting habitat may be affected in the short-term, and possibly have take of the Indiana bat due to timber operation accidents and timing of timber operations. Project activities should show long-term improvements for this species.

Foraging - The principal objective of uneven-aged harvest would be to promote structural diversity, (a diversity of tree age classes) within hardwood stands. Harvest units using group selection would be limited to areas of 3 acres or less. Uneven-aged harvest, by either single-tree or group selection, would reduce canopy closure, mimicking natural gap formation in old-growth forests, that would result in multiple age classes of trees within stands (USDI FWS 2006).

One of the main structural effects of uneven-aged management is the creation of gaps in the canopy. The creation of gaps increases the amount of sunlight reaching the forest floor, resulting in a substantial response by herbaceous plants, tree seedlings, and shrub species. This response creates a distinct change in the stand structure, producing more diversity in terms of vertical layering and understory species and may increase the diversity of insects preyed upon by Indiana bats.

The availability of highly suitable foraging habitat across the Forest, is equivocal due to the substantial degree of canopy closure within hardwood stands. Single-tree selection harvest and group selection harvest (part of the thinning, selection cuts and mid-story removal) would create small canopy gaps, and are likely to result in improved suitability of foraging habitat for Indiana bats, as these methods are likely to achieve reduction in crown closure approaching that considered suitable for the Indiana bat (USDI FWS 2006).

Given the density of trees on the Forest, it may be reasonable to think of timber harvest as an appropriate means to improve Indiana bat habitat on the Hoosier National Forest. The action area represents only a small portion of the available foraging habitat for the Indiana bat on National Forest System lands. Therefore, the proposed project may affect foraging for the Indiana bat, by providing forest gaps, structural diversity and a reduction of basal area (reducing clutter for bats). These effects may benefit the Indiana bat inside the action area and in the vicinity of the action area.

Vernal pools are a valuable water source for bat species and provides a forage area for insects as well. Indiana bats have been captured in a vernal pool complex on the Pleasant Run Unit in 2010 (McClanahan 2010) along with other sensitive bat species. Due to the installation of vernal pools at some of the road sites, this would help bat species and create a beneficial effect for the Indiana bat.

Travel Corridors - Existing roads in the harvest areas would be less cluttered as a result of this project. Temporary skid trails could also be used inside the action area. Both of these would provide better travel corridors for the Indiana bat. After the temporary skid trails have served their function, these areas could be re-purposed to serve as vernal pools where appropriate. This would benefit the Indiana bat by providing a water source, enhancing the travel corridors and improving foraging opportunities.

To summarize, project activities should not affect winter hibernacula or staging/swarming of the Indiana bat directly or indirectly. Project activities may affect summer habitat, roosting habitat, foraging habitat and travel corridors. Effects to summer, roosting, foraging habitat and travel corridors are believed to be short-term with project activities showing long-term improvements with increased solar exposure for maternity colonies, potential roost creation, increase in plant/insect diversity (better foraging potential) and an increased water supply by vernal pool creation.

Rough pigtoe mussel (*Pleurobema plenum*)

The rough pigtoe typically occurs in coarse sand-gravel-cobble substrates of medium to larger sized rivers. Within the vicinity of the proposed Houston South Project, there are no known records of the rough pigtoe (IDNR 2012, 2015).

The main stem of the East Fork of the White River in Martin County, Indiana, is the only location where the rough pigtoe may occur within the Hoosier National Forest boundary. Records of occurrence consist of weathered or fresh dead shells collected by Indiana Department of Natural Resources. This location is over 28 miles from the action area. A second known location, outside of the Forest boundary, occurs in the East Fork of the White River, Jackson County greater than 10 miles away.

There are no known occurrences of the rough pigtoe in the action area, no habitat for the species and the project would not alter or affect restoration of natural stream flows in the East Fork White River or its tributaries. Therefore, there would be no direct, indirect or cumulative effects to this species from implementing this project.

Northern long-eared bat (*Myotis septentrionalis*)

This bat relies on intact interior forest habitat, with low edge-to-interior ratios. Relevant late-successional forest features include a high percentage of old trees, uneven forest structure (resulting in multilayered vertical structure), single and multiple tree-fall gaps, standing snags and woody debris. These late successional forest characteristics may be favored for several reasons, including the large number of partially dead or decaying trees that the species uses for breeding, summer day roosting, and foraging (NatureServe 2019, USDI, FWS 2014, USDI, FWS 2013). Northern long-eared bats most likely are not dependent on a certain species of trees for roosts throughout their range; rather, certain tree species will form suitable cavities or retain bark and the bats will use them opportunistically (Foster and Kurta 1999, p. 668).

There are no known occurrences of the northern long-eared bat within the action area according to the Indiana Heritage Database (IDNR 2015, 2012). In June 2011, three northern long-eared bats were captured inside the action area east of the Maumee Boy Scout Camp (McClanahan 2011). In June 2010, 14 northern long-eared bats were captured in a vernal pool complex approximately 0.25 miles from the action area and an additional 8 were captured in the Hardin Ridge Recreation Area approximately 6 miles from the action area (McClanahan 2010).

The US Fish and Wildlife Service has not designated or proposed critical habitat for the northern long-eared bat. Therefore, the Hoosier national Forest has no critical habitat for this bat species. No known hibernacula exist in the action area. The closest hibernaculum is over 3.5 miles away and there are no known northern long-eared bat maternity trees in the vicinity of the action area. It is assumed however, they are utilizing habitat within the cumulative effects boundary, but there have been no documentation of northern long-eared maternity roosts on the forest. Suitable spring staging/fall swarming habitat for northern long-eared bat is most typically within 5 miles of a hibernaculum (USDI FWS 2014).

Since there potentially are a number of northern long-eared hibernacula within 10 miles of Hoosier National Forest, it is likely that northern long-eared bats use appropriate habitats on the Hoosier National Forest for roosting and foraging.

Night roosts used in summer between foraging bouts are in different habitats than day roosts. Caves, mines, and quarry tunnels are used as night roosts, typically by males, but also by nonreproductive females.

Daytime observations typically are of individuals in crevices or hollows or under loose bark on trees and in a variety of small spaces associated with buildings and other structure. In 2004, northern long-eared bats were also discovered using bridges during daytime roost surveys on the Hoosier National Forest.

White-nose syndrome (WNS) is known to occur in this species. The northern long-eared bat has experienced a sharp decline in the northeastern part of its range, as evidenced in hibernacula surveys (Harriss 2018). Hibernation occurs in caves, mines, and tunnels from late fall through early spring (Kurta 1982, Mumford and Cope 1964, Jackson 1961, Griffin 1940 and others). Hibernators frequently roost in crevices, drill holes and similar sites (Caire et al. 1979, Pearson 1962, Layne 1958, Griffin 1940), but roosting in the open is not uncommon.

White-nose syndrome is the primary factor affecting the status of the northern long-eared bat, which has caused dramatic and rapid declines in abundance, resulting in the local extirpation of the species in some areas. Our analysis of the effects of activities that may affect the northern long-eared bat, but do not cause prohibited take, indicates that the additional loss of individual northern long-eared bat resulting from these activities would not exacerbate the effects of WNS beyond the local population level.

Even if all anthropogenic activities that might adversely affect northern long-eared bat ceased, we (the Service) do not believe that the resulting reduction in adverse effects would materially change the devastating impact WNS has had, and will continue to have, on northern long-eared bat at the local population level or at larger scales (USDI FWS 2016, 2015).

Vernal pools are a valuable water source for bat species and provides a forage area for insects as well. Fourteen northern long-eared bats were captured in a vernal pool complex on the Pleasant Run Unit in 2010 along with Indiana bats and other species. Due to the installation of vernal pools at some of the road sites, this would help bat species and create a beneficial effect for the northern long-eared bat.

Because there is a known hibernaculum within 5 miles of the action area (in the cumulative effects area), the proposed Houston South Project could affect swarming/staging behavior of the northern long-eared bat, due to prescribed burn activity and timber operations. Timber operation effects to summer, swarming/staging habitat, roosting, foraging habitat and travel corridors are believed to be short-term with long-term benefits.

Incidental take of northern long-eared bats resulting from tree removal is prohibited if it: (1) occurs within 0.25 miles of known northern long-eared bat hibernacula; or (2) cuts or destroys known, occupied maternity roost trees during June and July (USDI FWS 2016). Because there are no known hibernacula within 0.25 miles of the action area and there are no known maternity roost trees in the action area,

incidental take from tree removal activities and prescribed fire is not prohibited under the final 4(d) rule for northern long-eared bat (USDI FWS 2016).

In summary, project activities should not affect winter hibernacula of the northern long-eared bat directly or indirectly. Project activities may affect summer habitat, swarming/staging habitat, roosting habitat, foraging habitat and travel corridors. Effects to summer, swarming/staging habitat, roosting, foraging habitat and travel corridors are believed to be short-term with project activities showing long-term improvements with increased solar exposure for maternity colonies, potential roost creation, increase in plant/insect diversity (better foraging potential) and an increased water supply by vernal pool creation.

VIII. Cumulative Effects

The Houston South Project would not alter or create habitat suitable for the fanshell mussel, sheepsnose mussel or rough pigtoe mussel. The project would contribute no detrimental cumulative impacts to these species. This interpretation is independent of either time frame of analysis or the extent of the analysis area. That is, regardless of the timeframe or area of analysis, the proposed project would contribute no cumulative impact (beneficial or detrimental) to these species.

The Houston South Project would alter or create habitat suitable for the Indiana bat, gray bat and northern long-eared bat. There would be both direct and indirect effects and both short-term and long-term effects to these three bat species.

The cumulative effects geographical boundary was formulated by the potential effects ranking to the six listed species. It was also based on the significance of the project's impact on natural resources and then given a distance proportional to this impact. Since this project is wide-ranging, would be completed in a longer time span of over 10 years and may affect bat species that can forage over longer distances, a 5-mile buffer was established for the cumulative effects geographical boundary. This is also consistent with the cumulative effects geographical boundary for the Regional Foresters Sensitive Species BE (Harriss 2019).

The cumulative effects temporal boundary for this project was determined to be 20 years out. This was based on the current life of the Forest Plan and the approximate time of the project duration (12-15 years). It was logical to add an additional 5 years onto the project duration timeline to analyze effects after the implementation would be complete. Therefore, all future activities that may occur inside the cumulative effects geographical boundary would be considered up to 20 years.

There are no municipal, county, or state projects known to be proposed within the action analysis area. However, it is assumed that standard maintenance on highways, county roads and right-of-ways would continue. Past activities that have likely affected Federally listed species within the Forest boundary include conversion of riparian areas to agricultural or residential uses, timber harvest, wildfire and grazing.

Present or reasonably foreseeable future activities, which may have an impact on these species, include the construction or use of roads, continued agricultural use, timber harvest and activities associated with residential development. Private lands near the proposed action area will continue to be a mix of forest, open pasture and crop fields. See Table 4 for a complete list of potential activities that are the most appropriate to consider for this cumulative effects analysis.

The past, present or foreseeable Forest Service activities near the action area that could directly or indirectly affect the three bat species (or potentially cause additive or synergistic adverse cumulative impacts in conjunction with the proposed action) are: the continuation of early successional management (Forest Openings Maintenance), wetland maintenance, the Buffalo Pike Project, potential trail re-routes, Pleasant Run Road Decommissioning, Lake and Pond Habitat Improvement, Jackson County AOPs,

Fork Ridge Restoration and NNIS herbicide applications. The vast majority of these activities are considered not likely to result in direct take of the Indiana bat and have a beneficial effect on local bat species.

The only project that had incidental take of Indiana bats associated with it, in the vicinity of the project, is the Buffalo Pike Project. Buffalo Pike take has been accounted for in the Programmatic Biological Opinion and timber operations have been completed. The Forest Service is actively installing vernal pools in this area at present. The determination for Buffalo Pike was that the project **“may affect”** foraging and travel corridors for the Indiana bat and the northern long-eared bat. It was **“not likely to adversely affect”** these species due to enhancement of travel corridors and foraging areas and the addition of vernal pools. Also, project activities were **“likely to adversely affect”** summer and roosting habitat for these two species but would not modify critical habitat. This **“likely to adversely affect”** call is due to potential timber operation accidents and the removal of potential roost trees without seasonal restrictions. Therefore, the effects of the Buffalo Pike Project and the Houston South project are discussed cumulatively below.

The Buffalo Pike Project BE (Harriss 2014) did not consider the gray bat to be present at the time of its creation. As a result, a “no effect” determination was used for all bat components of this species. Therefore, there are no cumulative effects for the gray bat coming from the Buffalo Pike Project.

Because there are no known Indiana bat or gray bat hibernacula inside or in the immediate vicinity of the action area, the proposed Houston South Project would result in **“no effect”** to hibernacula of the Indiana bat and gray bat nor affect swarming or staging behavior of the Indiana bat and gray bat. Project activities for the Buffalo Pike Project also resulted in **“no effect”** to hibernacula of the Indiana bat nor affect swarming or staging behavior of the Indiana bat. Cumulatively, there would be no additional effects on hibernation, staging or swarming from these two separate projects.

Due to the presence of a known northern long-eared bat hibernaculum within 5 miles of the action area, the proposed Houston South Project would result in a **“may effect”** to hibernacula of the northern long-eared bat. This effect would be specifically on staging and swarming and a result of prescribed fire and timber operations that could occur without time constraints. It is **“not likely to adversely affect”** this species due to long-term benefits produced by prescribed fire, the creation of more roosting opportunities and the increase of forest sustainability throughout the action area. Project activities for the Buffalo Pike Project resulted in **“no effect”** to swarming or staging behavior of the northern long-eared bat. Cumulatively, there would be no additional effects on staging or swarming, from these two separate projects, concerning the northern long-eared bat.

Project activities **“may affect”** foraging and travel corridors for the Indiana bat, northern long-eared bat and gray bat. This would be a beneficial and long-term effect. It is **“not likely to adversely affect”** these species due to enhancement of travel corridors and foraging areas and the addition of vernal pools and enhancement of water quality/aquatic insects. Project activities for the Buffalo Pike Project determined the same conclusion. This **“may affect”** however was beneficial and promoted habitat enhancements for the Indiana and northern long-eared bat. Therefore, there would be a cumulative benefit coming from both projects.

Project activities are **“likely to adversely affect”** summer and roosting habitat for the Indiana bat and northern long-eared bat but would not modify critical habitat. This **“likely to adversely affect”** call is due to potential timber operation accidents, prescribed fire during the bats active period and the removal of potential roost trees without seasonal restrictions. This would be considered “take” of the Indiana bat and is covered under the Forest’s Incidental Take Statement. Project activities for the Buffalo Pike Project determined the same conclusion.

Timber operations for Buffalo Pike were completed in early 2018. There may still be effects from the timber operations taking place. If bats were in that action area and were displaced, by now they could have found new roost trees created by the project and alternate roosts. It is believed there are no longer negative direct effects from the Buffalo Pike Project affecting summer and roosting habitat. Indirect effects could be ongoing. Beneficial effects would be ongoing such as the vernal pool installments, new roosting tree creation and increased solar exposure. Therefore, cumulative effects from both projects could occur but no direct negative effects are anticipated.

Project activities would also have “**no effect**” to the gray bat’s roosting habitat. This is due to the lack of known gray bat hibernacula in the action area or within the cumulative effects boundary.

Lastly, the likelihood of the fanshell mussel, sheepsnose mussel or rough pigtoe mussel inhabiting the action area is distinctly remote, the project would result in “**no effect**” to these species. Nor would the project contribute any detrimental cumulative impacts to these species. Because none of the above species have documented occurrences within or in the immediate vicinity of the project and the proposed project does not affect overall habitat quality for these species, the proposed project would contribute no cumulative effects to these species or their habitat.

Other Forest activities, excluding Buffalo Pike, are considered to have no negative effects on the Indiana bat, northern long-eared bat and gray bat. Consequently, the proposed Houston South Project would not cumulatively affect (negatively) the Indiana bat for these past, present or foreseeable activities.

Table 4.
Past, Present, and Reasonably Foreseeable Future Action Within or Around the Proposed Project Area.

	ACTION	PAST	PRESENT	REASON- ABLY FORESEE- ABLE	Description
1.	Natural gas and power right-of-way maintenance	x	x	x	Mowing, brushing, herbicide applications
2.	State and County Road maintenance	x	x	x	Mowing, brushing, herbicide, de-icing solutions
3.	Privately owned pasture or crop land	x	x	x	Herbicide applications, mowing, plowing, disking
4.	Private timber operations	x	x	x	Tree removal, road/skid/landing construction
5.	Maintenance of Forest Service roads	x	x	x	Ditch cleaning, grading, graveling on “open to Public” roads
6.	USFS Pleasant Run Road decommissioning		x	x	Decommission 13 roads and 52 road segments
7.	USFS Buffalo Pike timber sale	x			43 acres single tree / group tree selection harvest
8.	USFS Trail Reroutes	x		x	Trail reroutes, close/obliterate old trail, re-contour

	ACTION	PAST	PRESENT	REASON- ABLY FORESEE- ABLE	Description
9.	Maintenance of established USFS trails	x	x	x	Mowing, brushing, grading, gravel placement
10.	Maintenance of Forest wildlife openings	x	x	x	Mowing, brushing, cutting, prescribed burning
11.	USFS Houston Pin Oak Wetlands	x	x		Created shallow water wetlands
12.	USFS Lake and Pond Habitat Improvement	x	x	x	Cutting and dropping trees into lakes and ponds
13.	Non-native Invasive Species (NNIS) treatments. USFS and private lands	x	x	x	Manual, Mechanical and/or Herbicide control methods
14.	USFS Jackson County AOPs (2)		x		Aquatic organism passage reconstruction
15.	USFS Fork Ridge Restoration	x	x	x	Prescribed burning of 820 acres

IX. Design Criteria and Recommendations

Based upon inspection of the action area and proposed activities, I recommend implementation of the following considerations.

- *Implement Standards and Guidelines from the Forest Plan, maximize the benefit to Indiana bats and protect the gray bat (USDA FS 2006 pages 3-3 through 3-5). **
- *Equipment should be cleaned of mud and seeds to prevent spread of NNIS before entering area **
- *Dates of prescribed burning and fireline placement may need re-evaluated based on future sensitive species research findings. Coordinate with the wildlife biologist on current findings. **
- *Removal of hazard trees for fireline prep will be completed prior to April 15 and after September 15**
- *Midstory and crop tree release tree removal will be completed prior to April 15 and after September 15**
- *Install vernal pools on temporary skid trails or pathways, to be abandoned, where appropriate.*
- *Promote pollinator habitat by native seeding of early successional areas and timber harvest areas where appropriate*
- *Allow dead trees and woody debris to decompose naturally on the ground via non-removal and/or create habitat piles where appropriate.*
- *Trees that would provide the best potential for roosting bats shall not be removed from the early successional areas inside the action area.*

- Minimize ground disturbance (duff layer).

**Design Criteria*

X. Determination

Based on the above information, this evaluation determines that the proposed project would have “**no effect**” on eastern fanshell, sheepsnose mussel and rough pigtoe. Since there are no effects on these species or their habitats from this project, this project would not contribute any cumulative effects to these species.

The proposed project is “**likely to adversely affect**” the Indiana bat. Since other potential Forest activities are considered to have no negative direct effects on the Indiana bat, the proposed Houston South Project would not cumulatively affect (negatively) the Indiana bat. This project would have no additional effects on the Indiana bat beyond those previously identified and evaluated in the Hoosier National Forest Programmatic Biological Assessment (USDA FS 2005) and the USDI Fish and Wildlife Service Programmatic Biological Opinion of the Hoosier National Forest Land and Resource Management Plan (USDI FWS 2006).

The proposed project is “**likely to adversely affect**” the northern long-eared bat. Since other potential Forest activities are considered to have no direct negative effects on the northern long-eared bat, the proposed Houston South Project would not cumulatively affect (negatively) the northern long-eared bat. This project would have no additional effects on the northern long-eared bat beyond those previously identified and evaluated in the 4(d) Rule for the Northern Long-Eared Bat Project (USDI FWS 2016).

The proposed project “**may affect, but not likely to adversely affect**” the gray bat. Since other potential Forest activities are considered to have no negative effects on the gray bat, the proposed Houston South Project would not cumulatively affect (negatively) the gray bat. This project would have no additional effects on the gray bat beyond those previously identified and evaluated in the Hoosier National Forest Programmatic Biological Assessment (USDA FS 2005) and the USDI Fish and Wildlife Service Programmatic Biological Opinion of the Hoosier National Forest Land and Resource Management Plan (USDI FWS 2006).

Effects of the proposed project on Federally endangered, threatened, or proposed species known to occur on the Hoosier National Forest are summarized in Table 5.

Prepared by:

/s/ Steve Harriss June 13, 2019

Steve Harriss
Wildlife Biologist
Hoosier National Forest

SUMMARY OF EFFECTS DETERMINATIONS¹ TO FEDERALLY THREATENED AND ENDANGERED SPECIES WITH RESPECT TO IMPLEMENTATION OF THE PROPOSED HOUSTON SOUTH PROJECT

Table 5.

Federally Listed Species:	Status	Species Present	Habitat Present	Species Affected	Habitat Affected	Effects
Fanshell <i>Cyprogenia stegaria</i>	E	No	No	No	No	NE
Gray bat <i>Myotis grisescens</i>	E	Yes	Yes	Yes	Yes	NL
Indiana bat <i>Myotis sodalis</i>	E	Yes	Yes	Yes	Yes	LT
Rough pigtoe pearly mussel <i>Pleurobema plenum</i>	E	No	No	No	No	NE
Northern long-eared bat <i>Myotis septentrionalis</i>	T	Yes	Yes	Yes	Yes	LT
Sheepnose mussel <i>Plethobasus cyphus</i>	E	No	No	No	No	NE

NE = no effect / no adverse modification:

"This conclusion is reached if the proposed action and its interrelated and interdependent actions will not directly or indirectly affect listed species or destroy/adversely modify designated critical habitat."

NL = May affect, is not likely to adversely affect species / adversely modify critical habitat:

"This conclusion is appropriate when effects to the species or critical habitat are expected to be beneficial, discountable or insignificant. Beneficial effects are contemporaneous positive effects without any adverse effects to the species or habitat. Insignificant effects relate to the size of the impact (and should never reach the scale where take occurs), while discountable effects are those that are extremely unlikely to occur."

LT = May affect, is likely to adversely affect species / adversely modify critical habitat:

"This conclusion is reached if any adverse effect to listed species or critical habitat may occur as a direct or indirect result of the proposed Service action or its interrelated or interdependent actions, and the effect is not discountable or insignificant (see definition of "is not likely to adversely affect"). In the event that the overall effect of the proposed action is beneficial to the listed species or segments of the critical habitat, but may also cause some adverse effect on individuals of the listed species or segments of the critical habitat, then the determination should be "is likely to adversely affect."

1 USDI Fish and Wildlife Service and National Marine Fisheries Service. 1998. Endangered Species Act Consultation Handbook. Procedures for Conducting Section 7 Consultations and Conferences.

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Figure 1.

Houston South Vegetation Management and Restoration Project Hoosier National Forest - Brownstown Ranger District

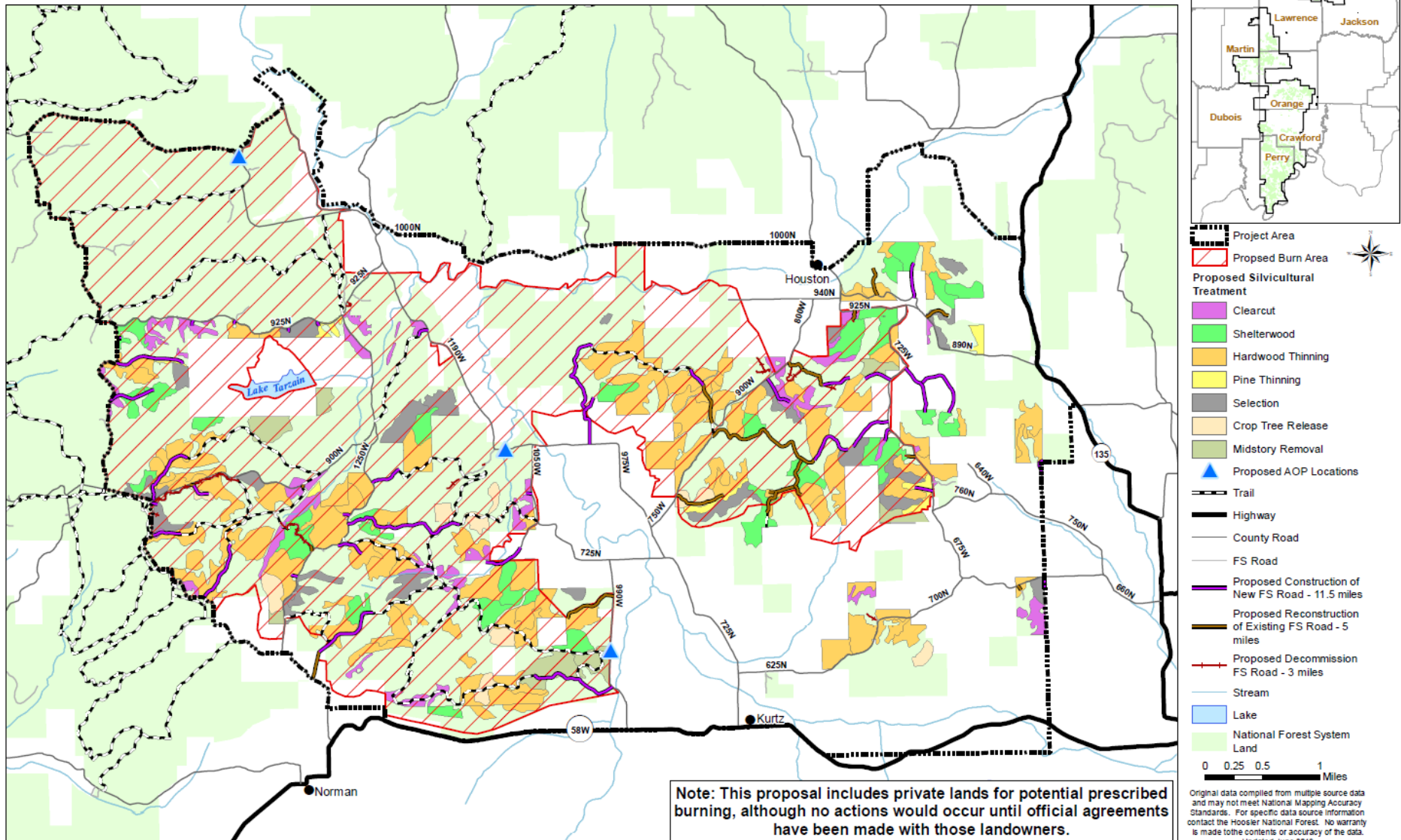


Figure 2.
A Prescribed Burn in the Houston South Area (Fork Ridge) Showing Representative Conditions
April 3, 2019



Figure 3.
Habitat Conditions of a Typical Early Successional Area in Houston South



Figure 4.
Habitat Conditions Post Prescribed Burn at Fork Ridge June 13, 2019



Figure 5.
Habitat Conditions Post Prescribed Burn at Fork Ridge June 13, 2019

